National Semiconductor

February 1995

LM140L/LM340L Series 3-Terminal Positive Regulators

General Description

The LM140L series of three terminal positive regulators is available with several fixed output voltages making them useful in a wide range of applications. The LM140LA is an improved version of the LM78LXX series with a tighter output voltage tolerance (specified over the full military temperature range), higher ripple rejection, better regulation and lower quiescent current. The LM140LA regulators have $\pm 2\%$ V_{OUT} specification, 0.04%/V line regulation, and 0.01%/mA load regulation. When used as a zener diode/resistor combination replacement, the LM140LA usually results in an effective output impedance improvement of two orders of magnitude, and lower quiescent current. These regulators can provide local on card regulation, eliminating the distribution problems associated with single point regulation. The voltages available allow the LM140LA to be used in logic systems, instrumentation, Hi-Fi, and other solid state electronic equipment. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

The LM140LA/LM340LA are available in the low profile metal three lead TO-39 (H) and the LM340LA are also available in the plastic TO-92 (Z). With adequate heat sinking the regulator can deliver 100 mA output current. Current limiting is included to limit the peak output current to a safe value. Safe area protection for the output transistor is provided to limit internal power dissipation. If internal power dissipation becomes too high for the heat sinking provided, the thermal shut-down circuit takes over, preventing the IC from overheating.

For applications requiring other voltages, see LM117L Data Sheet.

Features

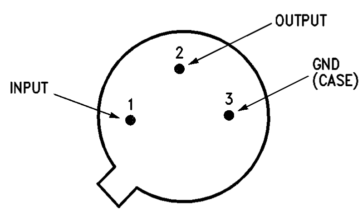
- Line regulation of 0.04%/V
- Load regulation of 0.01%/mA
- Output voltage tolerances of $\pm 2\%$ at $T_j = 25°C$ and
  $\pm 4\%$ over the temperature range (LM140LA)
  $\pm 3\%$ over the temperature range (LM340LA)
- Output current of 100 mA
- Internal thermal overload protection
- Output transistor safe area protection
- Internal short circuit current limit
- Available in metal TO-39 low profile package (LM140LA/LM340LA) and plastic TO-92 (LM340LA)

Output Voltage Options

LM140LA-5.0	5V	LM340LA-5.0	5V
LM140LA-12	12V	LM340LA-12	12V
LM140LA-15	15V	LM340LA-15	15V

Connection Diagrams

TO-39 Metal Can Package (H)

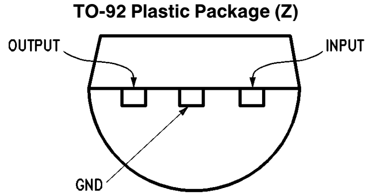


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Bottom View

Order Number LM140LAH-5.0, LM140LAH-5.0/883, LM140LAH-12, LM140LAH-12/883, LM140LAH-15, LM140LAH-15/883, LM340LAH-5.0, LM340LAH-12 or LM340LAH-15
See NS Package Number H03A

TO-92 Plastic Package (Z)



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Bottom View

Order Number LM340LAZ-5.0, LM340LAZ-12 or LM340LAZ-15
See NS Package Number Z03A

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Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications. (Note 4)

Input Voltage	35V
Internal Power Dissipation (Note 1)	Internally Limited
Operating Temperature Range	
LM140LA	−55°C to +125°C
LM340LA	0°C to +70°C
Maximum Junction Temperature	+150°C
Storage Temperature Range	
Metal Can (H package)	−65°C to +150°C
Molded TO-92	−55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	
Metal Can	+300°C
Plastic TO-92	+230°C

Electrical Characteristics

Test conditions unless otherwise specified. $T_A = -55°C$ to $+125°C$ (LM140LA), $T_A = 0°C$ to $+70°C$ (LM340LA), $I_O = 40$ mA, $C_{IN} = 0.33$ μF, $C_O = 0.01$ μF.

Output Voltage Option				5.0V			12V			15V			Units
Input Voltage (unless otherwise noted)				10V			19V			23V			
Symbol	Parameter	Conditions		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
V_O	Output Voltage	$T_j = 25°C$		4.9	5	5.1	11.75	12	12.25	14.7	15	15.3	V
	Output Voltage Over Temp. (Note 3)	LM140LA	$I_O = 1 - 100$ mA	4.8		5.2	11.5		12.5	14.4		15.6	V
				(7.2–20)			(14.5–27)			(17.6–30)			V
		LM340LA	$I_O = 1 - 100$ mA or $I_O = 1 - 40$ mA and $V_{IN} = (\ )V$	4.85		5.15	11.65		12.35	14.55		15.45	V
				(7–20)			(14.3–27)			(17.5–30)			V
ΔV_O	Line Regulation	$T_j = 25°C$	$I_O = 40$ mA, $V_{IN} = (\ )V$		18	30		30	65		37	70	mV
				(7–25)			(14.2–30)			(17.3–30)			mV
			$I_O = 100$ mA, $V_{IN} = (\ )V$		18	30		30	65		37	70	mV
				(7.5–25)			(14.5–30)			(17.5–30)			mV
	Load Regulation	$T_j = 25°C$	$I_O = 1 - 40$ mA		5	20		10	40		12	50	mV
			$I_O = 1 - 100$ mA		20	40		30	80		35	100	mV
	Long Term Stability				12			24			30		mV/1000 hrs
I_O	Quiescent Current	$T_j = 25°C$			3	4.5		3	4.5		3.1	4.5	mA
		$T_j = 125°C$				4.2			4.2			4.2	mA
ΔI_Q	Quiescent Current Change	$T_j = 25°C$	ΔLoad $I_O = 1 - 40$ mA			0.1			0.1			0.1	mA
			ΔLine $V_{IN} = (\ )V$			0.5			0.5			0.5	mA
				(7.5–25)			(14.3–30)			(17.5–30)			mA
V_N	Output Noise Voltage	$T_j = 25°C$ (Note 2), $f = 10$ Hz–10 kHz			40			80			90		μV
$\frac{\Delta V_{IN}}{\Delta V_{OUT}}$	Ripple Rejection	$f = 120$ Hz, $V_{IN} = (\ )V$		55	62		47	54		45	52		dB
				(7.5–18)			(14.5–25)			(17.5–28.5)			dB
	Input Voltage Required to Maintain Line Regulation	$T_j = 25°C$, $I_O = 40$ mA		7			14.2			17.3			V

Note 1: Thermal resistance of H-package is typically 26°C/W θ_{jC}, 250°C/W θ_{jA} still air, and 94°C/W θ_{jA} 400 lf/min of air. For the Z-package is 60°C/W θ_{jC}, 232°C/W θ_{jA} still air, and 88°C/W θ_{jA} at 400 lf/min of air. The maximum junction temperature shall not exceed 125°C on electrical parameters.

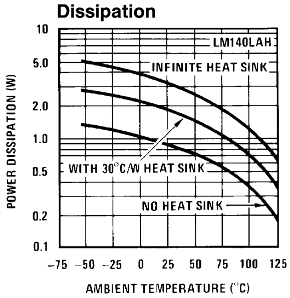
Note 2: It is recommended that a minimum load capacitor of 0.01 μF be used to limit the high frequency noise bandwidth.

Note 3: The temperature coefficient of V_{OUT} is typically within 0.01% V_O/°C.

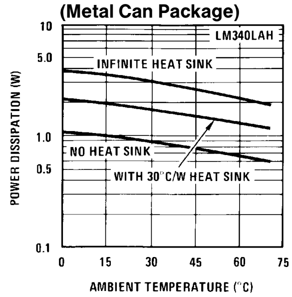
Note 4: A military RETS specification is available upon request. At the time of printing, the LM140LA-5.0, -12, and -15 RETS specifications complied with the Min and Max limits in this table. The LM140LAH-5.0, LM140LAH-12, and LM140LAH-15 may also be procured as Standard Military Drawings.

Typical Performance Characteristics

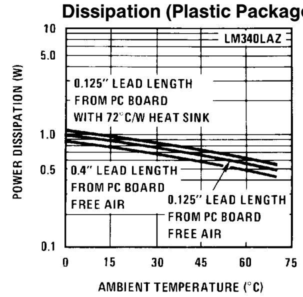
Maximum Average Power Dissipation



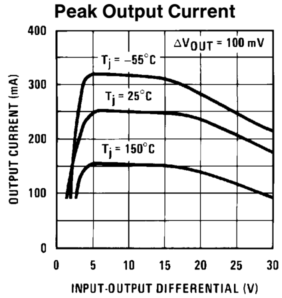
Maximum Average Power Dissipation (Metal Can Package)



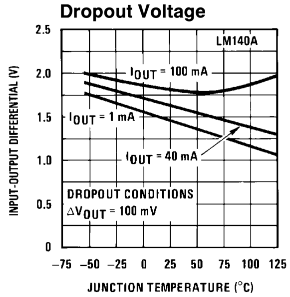
Maximum Average Power Dissipation (Plastic Package)



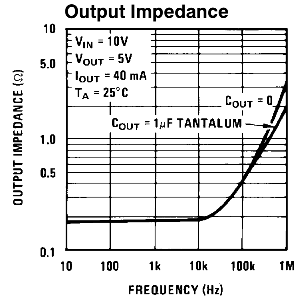
Peak Output Current



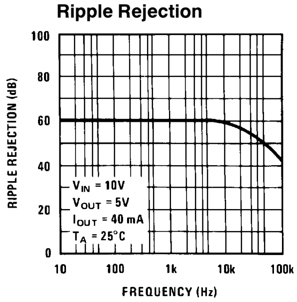
Dropout Voltage



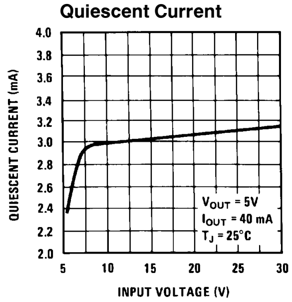
Output Impedance



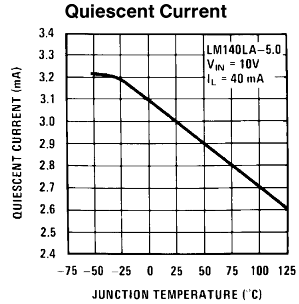
Ripple Rejection



Quiescent Current



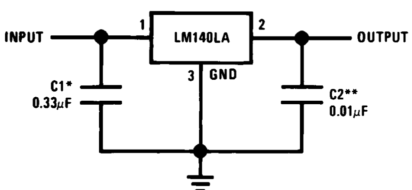
Quiescent Current



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Typical Applications

Fixed Output Regulator

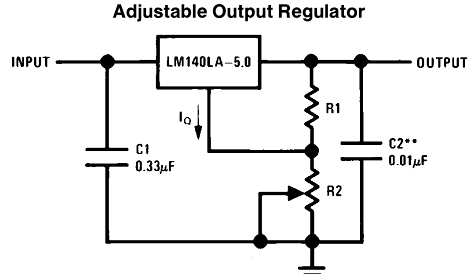


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*Required if the regulator is located far from the power supply filter.

**See note 3 in the electrical characteristics table.

Adjustable Output Regulator

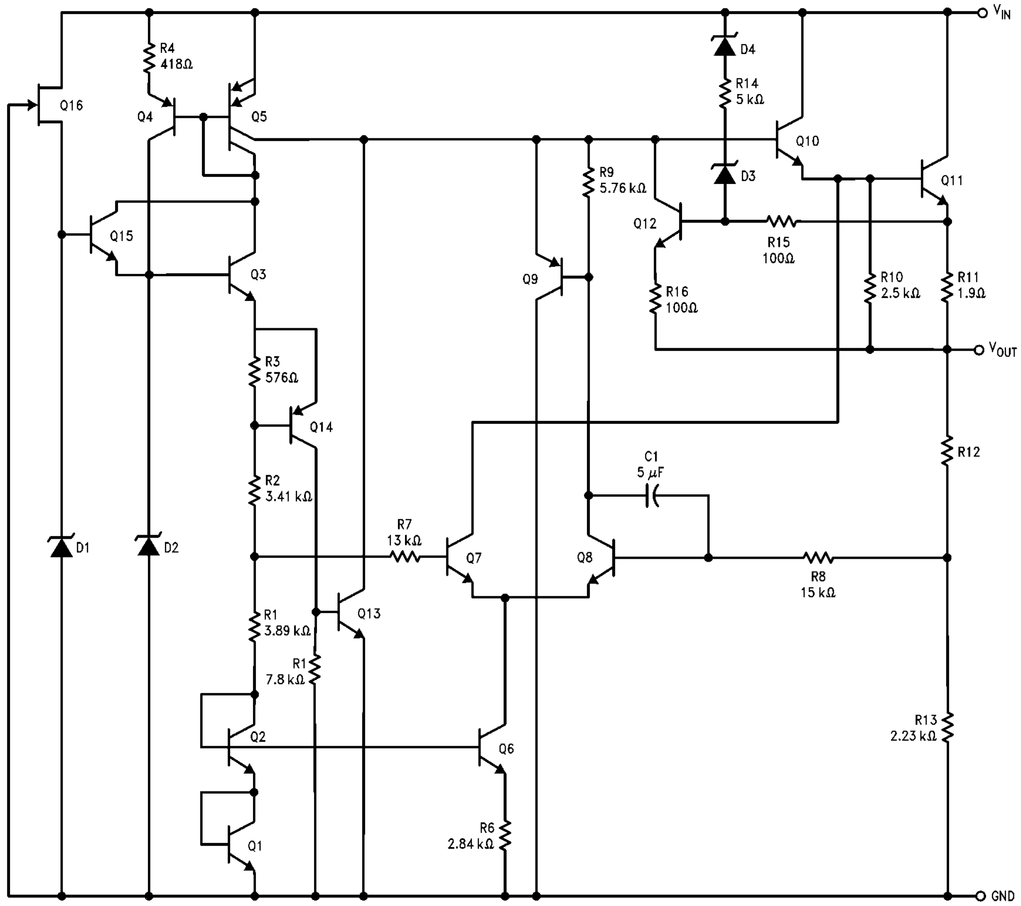


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$V_{OUT} = 5V + (5V/R1 + I_Q) R2$

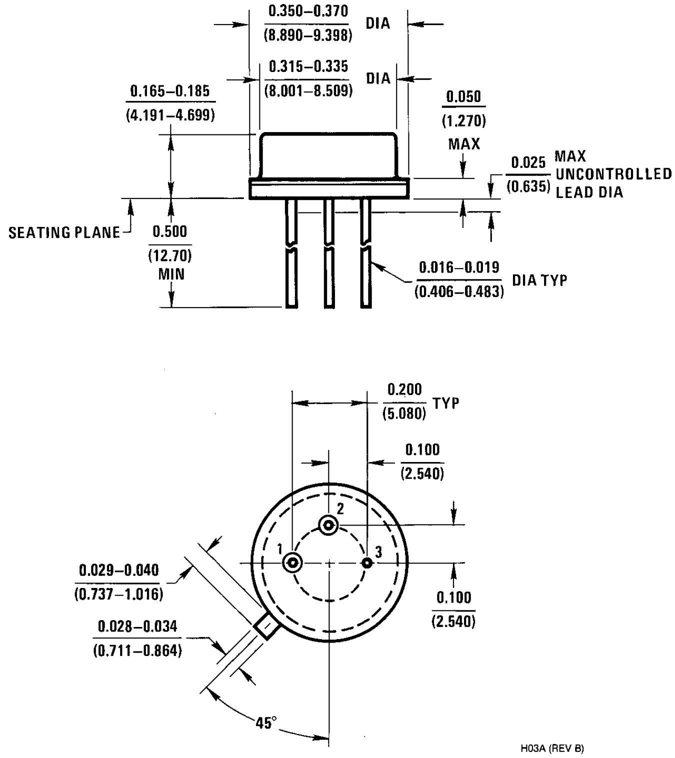
$5V/R1 = 3\ I_Q$ load regulation (L_r) ≈ [(R1 + R2)/R1] (L_r of LM140LA-5.0)

Equivalent Circuit



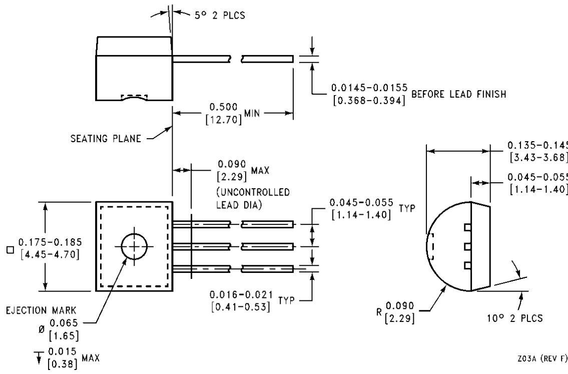
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Physical Dimensions inches (millimeters)



TO-39 Metal Can Package (H)
Order Number LM140LAH-5.0, LM140LAH-5.0/883, LM140LAH-12, LM140LAH-12/883, LM140LAH-15, LM140LAH-15/883, LM340LAH-5.0, LM340LAH-12 or LM340LAH-15
NS Package Number H03A

Physical Dimensions inches (millimeters) (Continued)



TO-92 Plastic Package (Z)
Order Number LM340LAZ-5.0, LM340LAZ-12, or LM340LAZ-15
NS Package Number Z03A

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